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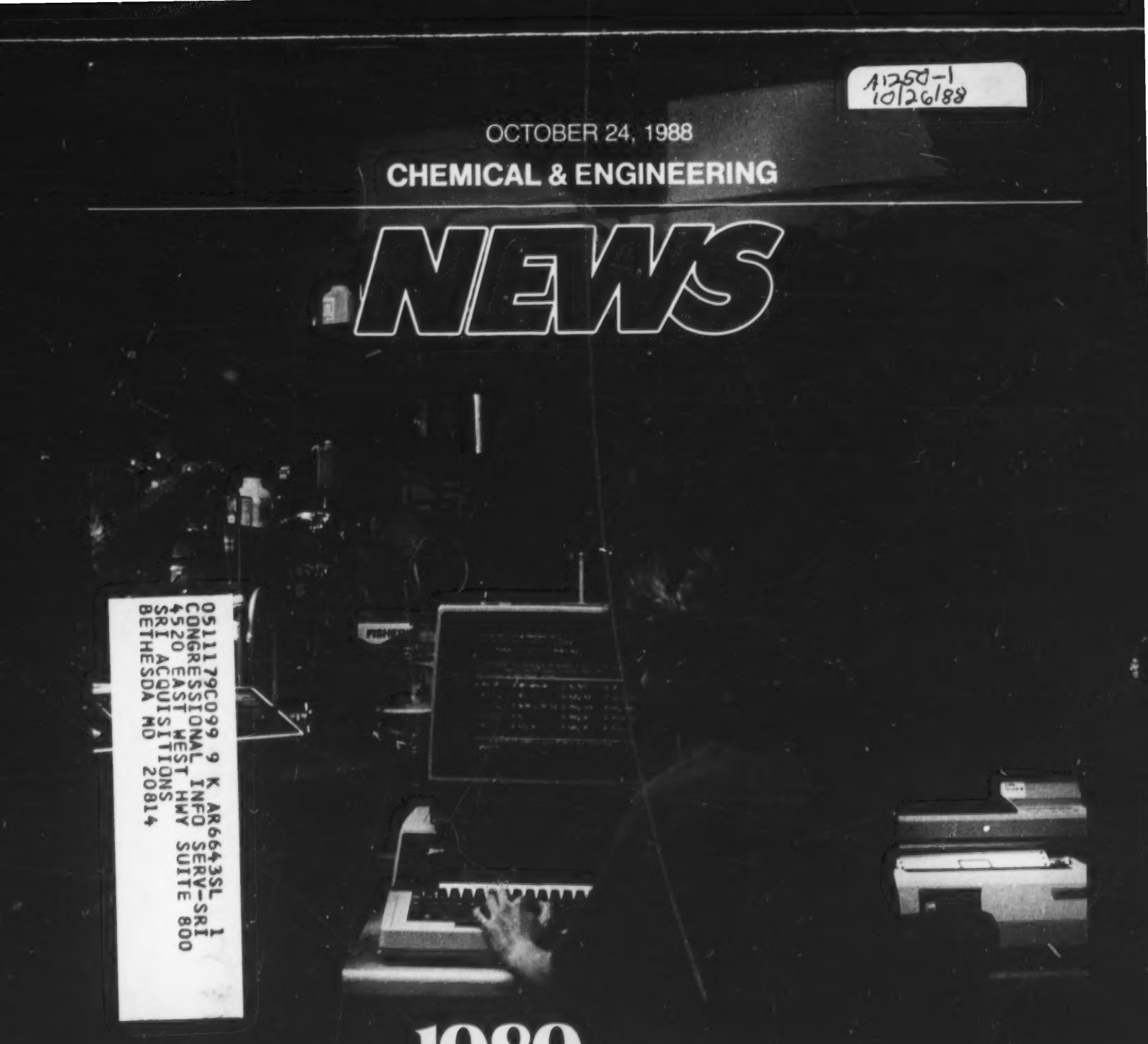
OCTOBER 24, 1988

CHEMICAL & ENGINEERING

NEWS



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1989 Employment Outlook

Computers offer wide potential for undergraduate education

Page 29

CHEMICAL & ENGINEERING NEWS

Volume 66, Number 43
CENEAR 66 (43) 1–84
ISSN 0009-2347

OCTOBER 24, 1988

News of the Week

■ **Three West German researchers win Nobel Prize in Chemistry for their work on photosynthesis; two Americans and a Briton win prize in medicine for drug research; and physics prize goes to three U.S. scientists for neutrino studies.** **Page 4**

■ **The French government launches a study of the country's chemical industry to evaluate the need for structural changes in light of move to unify European Community market in 1992.** **Page 5**

■ **Hercules is commercializing a food packaging system that will extend the shelf life of fresh fruits and vegetables.** **Page 6**

■ **Earnings rose once again for major U.S. chemical companies in the third quarter, although rates of increase have slowed from previous quarters.** **Page 6**

Cover: University of Kansas student uses computer-assisted instruction program in organic chemistry. Photo by Robin Loomis Kern

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Business

Ethyl *tert*-butyl ether may find use as an octane enhancer, if favorable ethanol feedstock prices can be obtained; BASF's Geismar, La., amines plant was built to protect market share; European Chemical Marketing Research Association meeting examined the chemical industry outside Western Europe, with the U.S.S.R., Japan, and South Korea particularly drawing interest. **Page 11**

Government

Pirating of U.S. patented chemicals in foreign countries continues to be a perplexing problem, but the industry is working hard to find solutions; Federal Laboratory Consortium for technology transfer promotes the rapid movement of research results from federal labs to the private and public sectors. **Page 16**

Education

Chemical engineering education celebrates centennial as profession faces global challenge in a changing world. **Page 21**

Science

Solid sodium chloride can affect atmospheric chemistry. **Page 22**

Technology

Polyurethane foams industry looks to promising alternatives to currently used chlorofluorocarbon blowing agents; method prepares particles with apparent cluster/colloid duality. **Page 23**

Books

"Acid Rain: Rhetoric and Reality," by Chris C. Park, addresses still-raging political and economic battles; second edition of "Hazardous and Toxic Materials" updates readers on important developments. **Page 49**

Employment Outlook

C&EN's annual look at the job market focuses on innovative computer techniques that can be used to help undergraduate students learn skills they will need in graduate research and in their careers. **Page 29**

Chemical & Engineering News

1155—16th St., N.W., Washington, D.C. 20036

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Published by
AMERICAN CHEMICAL SOCIETY
(202) 872-4600; TDD (202) 872-8733
John K. Crum, Executive Director

PUBLISHING BOARD: Ned D. Heindel (*Chairman*); *Board of Directors Chairman:* Ernest L. Eliel; *President:* Gordon L. Nelson; John H. Nelson; Louis D. Quin; Jean'ne M. Shreeve; and Barbara G. Wood

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Subscription Rates 1988. Printed editions: nonmembers U.S. 1 yr. $49, 2 yr. $83, outside U.S. 1 yr. $75, 2 yr. $135. Air freight rates available on request. Rates above do not apply to nonmember subscribers in Japan, who must enter subscription orders with Maruzen Co. Ltd., 3-10 Nihonbashi 2-chome, Chuo-ku, Tokyo 103, Japan. Tel: (03) 272-7211. Single copies: Current $7.00. Rates for back issues and volumes are available from Microforms & Back Issues Office, ACS, 1155—16th St., N.W., Washington, D.C. 20036. Back and current issues available on microfilm and microfiche. Rates on request from Microform Program, ACS.

Chemical & Engineering News (ISSN 0009-2347) is published weekly except for the last week in December by the American Chemical Society at 1155—16th St., N.W., Washington, D.C. 20036. Second-class postage paid at Washington, D.C., and additional mailing offices. POSTMASTER: Send address changes to Chemical & Engineering News, Membership & Subscription Services, P.O. Box 3337, Columbus, Ohio 43210. ACS assumes no responsibility for the statements and opinions advanced by the contributors to its publications.

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LETTERS

Benzene rings

SIR: The picture of benzene bonded to a rhodium surface and captioned "Benzene snapshot captures images of individual rings" (C&EN, Aug. 1, page 5) was very intriguing.

However, if the communication by Parker, Hexter, and Siedle, "Surface Conversion of Benzene to Acetylene," in the *Journal of the American Chemical Society* [**107**, 4584 (1985)] is correct, the addition of a pi-acceptor, such as carbon monoxide to stabilize benzene on the surface, resulted in a loss of resonance stabilization energy by the benzene and was balanced by the increased metal-carbon sigma bonding (two electrons to rhodium from the acetylene) and pi back-bonding in the three acetylenes and the rhodium. Therefore, the appearance of three two-atom clusters in the picture may be explained as acetylenes bonded to rhodium.

Jeffrey L. Moler
Research Chemist
James R. McCoy
Technical Area Manager
Aero Propulsion Laboratory
Wright-Patterson Airforce Base

Efforts to reduce cancer

SIR: Regarding John C. Bailar's article, "Rethinking the War on Cancer" in *Issues in Science and Technology*, and Ernest Volkmann's knowledgeable letter of response (C&EN, Aug. 8, page 3), we may be looking in the wrong place.

Several weeks ago I attended a conference sponsored by the Fetzer Foundation and others in Kalamazoo, Mich., and was introduced to the term psychoneuroimmunology. It is indeed a mouthful, but as a field of study it takes its premise from the research on the human immune system, on the brain's role in influencing this system, and, most important, the psychological state of the individual in this whole affair.

As I understand it from listening to several speakers (whose names, unfortunately, I do not recall), each of us can influence our own immune system by our beliefs, thoughts, feelings, and general psychological state. We do this continuously and more-or-less unconsciously. However, the result is that our immune systems respond by raising or lowering our resistance to viruses and other potentially harmful organisms. Thus our psychological state may well be a major factor in determining who gets cancer and who recovers or does not.

I understand that there is some research to support this, although it is still very new. Perhaps others in ACS can provide more specific information.

In any event, if the research supports the contention of the psychoneuroimmunologists, then at least we have a complementary perspective on the etiology of cancer and related diseases, and we might even find that our well-meaning efforts to reduce cancer by enlightening the general population on the subject induce enough fear and anxiety to accomplish the opposite. It is a sobering thought.

C. Philip Alexander
Ann Arbor, Mich.

Tax reform casualty

SIR: The letters from postdoctoral fellow Sheri L. Blystone (C&EN, June 27, page 2) and Pennsylvania State University graduate students Donald Cronce, Susan Ensel, and John Sczepanski (C&EN, April 25, page 3) have compelled me to share my tax burden plight with C&EN readers. I, too, am prompted to share my concerns about the 1986 National Tax Reform Act. I have fallen victim to it.

After finishing my Ph.D. in the fall of 1986, I served the state of Connecticut by accepting the first postdoctoral fellowship sponsored by the Connecticut Department of Health in cooperation with the University of Connecticut Institute of Water Resources. I designed and implemented a project on analysis of suspected cancer-causing compounds in Connecticut drinking water. During November and December 1986 my fellowship income was tax free. However, recently I found out (as did millions of others) that the tax laws had changed and that the fellowship payments I received in 1987 were now taxable. At the time, I was told by the University of Connecticut not to worry about filing a W-2 for the 1987 calendar year because the award was a fellowship. I now owe the IRS $1800 in back taxes and am in the process of paying the IRS $200 a month for nine months. I don't own a home, I'm married with one child and have another one on the way. To me, $200 a month is a lot of money. I left Connecticut and took a position in the

Correction

• Oct. 3, page 16: 100 to 125, not 100,000 to 125,000, cu ft of methane is required to make 1 gal of methanol in a plant using Lurgi technology similar to that used in Tenneco Oil's plant

U.S.S.R., Far East offer challenges to Western firms

Patricia L. Layman, C&EN London

With its theme of global issues and the chemical industry, the meeting earlier this month in Rome of the European Chemical Marketing Research Association looked at how global demand is changing the supply and marketing patterns for a number of industry sectors. It also proved an opportunity for the nearly 250 attending the conference to examine the chemical industry outside the bounds of Western Europe. The Soviet Union, in the midst of political change and restructuring (C&EN, Jan. 18, page 28), and the Far East, particularly Japan and South Korea, were of particularly high interest.

Despite the changing political climate in the Soviet Union, the Western company wishing to do business in the Soviet chemical sector would be well advised to remain resolutely realistic and keep a very long-range timetable, said Paul Zieber, head of the Hamburg-based Institute for Market Research in Eastern Europe.

According to Zieber, the Soviets now consider their chemical industry in two major sectors. One will have very little or no growth: most mineral mining products, chlorides, nitrogen, and commodity pesticides. Growth will be limited, in part, he pointed out, because of pollution concerns. The other sector will exhibit strong growth: plastics, synthetic fibers, synthetic rubber, tires, paints and lacquers, phosphate fertilizers, biological pesticides, and pharmaceuticals.

Petrochemicals will continue to be the center of development of the Soviet chemical industry until the year 2000, with oil and gas no longer considered "combustibles" but chemical raw materials. Major end uses will be the plastics industry, which will see massive development.

The Soviet chemical industry has already invested significant sums in development, but—according to Zieber's analyses—major proportions of those sums have gone into industrial equipment that has never been started up. Many chemical plants, he said, have never been put into operation, even after 10 years, or if they have been, are running at as low as 30% of capacity.

That dismal record has led to the Politburo decision, he added, that from now on, all investment plans that include Western technology are to be built by joint ventures. "In a joint venture, it is assumed that Western businessmen won't wait for years to bring a plant on stream—they will insist everything is hooked up, to come on stream."

The stated goal of the Soviet Union is to cut exports of basic chemicals, and begin exporting their higher-value-added derivatives. Until then, however, the pattern probably will remain similar to the current one. The U.S.S.R. imports roughly $4 billion of chemicals—specialty chemicals and basic chemicals in which the Soviets are short of capacity—and exports only $1 billion, generally basic chemicals—ammonia and petrochemicals.

The new plants planned will depend on the massive petrochemical complexes the U.S.S.R. is building. Joint ventures are important for these. There is one, for example, between the Ministry of the Petroleum Refining & Petrochemical Industry and Combustion Engineering and McDermott, to build petrochemical centers in western Siberia for producing aromatics, derivatives of aromatics and olefins, specialty rubber, alcohols, plastics, and lubricants. Another is planned with possible partners Chevron and Du Pont, and yet another with Occidental Petroleum, ENI and Montedison of Italy, and Marubeni of Japan.

What does the Soviet interest in joint ventures mean for the Western chemical industry? One answer came from Trevor Waldron, business development director at Monsanto Europe, who pointed out that Monsanto has been doing business since the 1950s in the Eastern bloc. The initial deals were with rubber vulcanization chemicals for auto tires, and have been extended to include agrochemicals, acrylonitrile-butadiene-styrene plastics, and various industrial chemicals.

The growing demand for and emphasis being placed on consumer products will mean a continuing demand for Western specialties, for end uses such as automotive, food packaging, and medical. The Soviets are working, Waldron said, to bring on stream their own capacity in the chemicals that will be needed, but "they will find it is just not possible to orchestrate the balanced development of specialty chemical production overnight."

Business in the chemical sector is also increasingly dependent on environmental qualities, he added, as the Soviets turn their attention to an area sadly neglected until recently. Monsanto has been negotiating a joint venture to produce herbicides since last year from its Moscow office, which Waldron anticipates expanding in personnel 20% per year for the next few years. According to Waldron, "Our potential partner's first question was not 'What's the process?' or 'How much does the plant cost?' It was 'What are the effluent and emission outputs?' It's an extremely hot issue, and there is a great deal of ground to cover."

Some 300 Soviet organizations are looking for foreign joint-venture partners, in addition to those already involved in the 500 or so joint-venture evaluations currently being conducted, and the nearly 100 already formed. However, he added, they can pose problems: "The objectives must be at least complementary, and that is difficult. The Eastern Europeans want technology and

Soviet demand for plastics set to grow quickly

Thousands of metric tons	1985	1990	1995	2000
Polyethylene	1102	1592	3,079	4,800
Polypropylene	93	213	641	1,000
Polystyrene, copolymers	466	610	1,010	1,400
Polyvinyl chloride, copolymers	455	815	1,355	2,200
TOTAL	2116	3230	6,085	9,400
TOTAL ALL PLASTICS	5019	7100	11,914	17,200

Source: Institute for Market Research in Eastern Europe

a means to earn foreign currency. We Westerners tend to just want a foothold in potentially massive markets."

Besides the usual preparation and the customer analyses needed, Waldron added, "It takes a lot of patience. They are usually big customers, and they know it. They are suspicious of 'capitalist' companies. You need to be prepared to invest a lot of time and money to build business." And it is important to participate in trade fairs and seminars, which are especially important to Socialist customers because they offer "neutral territory," according to Waldron. "It's not your office, or their ministry, and it is a more relaxed atmosphere than the typical business meeting."

Offering different kinds of challenges to Western chemical companies are the industries in South Korea and Japan.

Japanese investment in the chemical industry outside its borders has been slowly growing since the early 1980s, but still amounts to only about 10% of the $3.8 billion invested overseas by Japanese firms in 1986, said Takao Ayabe, executive managing director for Mitsui Toatsu Chemicals, Tokyo. On the other hand, in 1987, the stock price as a multiple of earnings was four or five times higher for Japanese chemical companies than for their counterparts in the U.S. or Western Europe, he pointed out. That makes acquisition of Japanese chemical companies prohibitively expensive.

Where U.S. and West European chemical companies have entered Japan, instead, is in the field of "leading-edge technologies," Ayabe noted. "By constructing factories and research facilities in Japan, European and American companies are demonstrating their growing commitment to the Japanese market." Examples he cited of such facilities included those of Bayer, Du Pont, Hoechst, ICI, and Monsanto.

The petrochemical sector, on the other hand, would hardly be attractive for Western industry. The Japanese chemical industry has gone through severe restructuring, with major capacity shutdowns throughout the industry. For example, between 1982 and the middle of this year, the industry, goaded by the Ministry of International Trade & Industry, cut ammonia capacity 40%, ethylene capacity 32%, polyolefin capacity 21%, polyvinyl chloride capacity 22%, ethylene oxide capacity 16%, and styrene capacity 19%, he said.

South Korean consumption of plastics to rise markedly

Thousands of metric tons	1977	1987	1997
Polyethylene	169	612	1318
Polypropylene	123	387	677
Polystyrene, copolymers	44	386	827
Polyvinyl chloride copolymers	145	380	837
TOTAL	481	1765	3659
TOTAL ALL PETROCHEMICALS	892	2928	5[illegible]92

Source: Yukong Ltd.

In the South Korean marketplace, on the other hand, producers have set their own expansion plans. Overcapacity likely will be the result, said J. R. Park, vice president for chemicals business at Yukong Ltd., the Seoul-based oil company.

The South Korean industry has had the unfortunate history of completing major chemical investments just when world economies go into recession, Park pointed out—a history that he hoped will not repeat itself as the industry is completing another building round. Encouraged by the government to expand petrochemical production in the 1960s as a means to cut imports, the chemical industry expanded production from roughly 15,000 metric tons in 1962 to 290,000 metric tons in 1972. The next round of expansions took place through the end of the 1970s, when demand growth rates in major petrochemical products were running anywhere from 15 to 26% per year.

As Ayabe observed, by 1980, "The industry was in dire need of rationalization measures, and restructuring had to be contemplated." Since then, however, growth has returned to the industry, enough to encourage a third round of major expansions, in what Park called "overheated investment in petrochemicals."

For example, current ethylene capacity in South Korea is 505,000 metric tons per year. Three additions or expansions are under way with startups scheduled between August 1989 and December 1991, to bring the total to 1.51 million metric tons per year. Moreover, said Park, plans for seven more ethylene plants have been announced, believed to be backward integrations or new entrants to the market, which would add yet another 2.25 million metric tons.

Also, ethylene producers have decided to integrate forward by adding polymer capacity. Existing capacity for polyethylene in South Korea is 445,000 metric tons. Another 340,000 metric tons is being added by existing producers, and seven companies have announced plans for capacity that will tack on another 852,000 metric tons per year.

In polypropylene, in which South Korea is already a net exporter, expansions are currently under way that will lift capacity from 450,000 metric tons to 610,000 metric tons per year. Announcements of polypropylene expansion plans from nine companies would add 1.07 million metric tons per year. Three of those new projects would be based on propylene derived from propane dehydrogenation in South Korea, said Park.

"The petrochemical industry in South Korea, albeit its structural problems, is a growing industry," he said, that will continue to grow through the late 1990s, when it will mature. Among the positive factors for the industry is its geographic proximity to "the huge unexplored markets—China and North Korea." It is clear, however, that South Korea will be a significant exporter of petrochemicals, particularly of polyolefins and polystyrenics, when all the expansions are completed. Until then, almost all petrochemicals, including ethylene and propylene, will have to be imported in "sizable volumes."

In other chemical industry sectors, he added, "there are innumerable vacancies in the petrochemical industry chart, and potential joint-venture partners and technology licensees can be located," offering business opportunities for Western companies. □